# Polarization-based smoke removal method for surgical images: supplement

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# A polarization-based smoke removal method for surgical images: supplemental document

The purpose of the modeling was to study the propagation of polarized photons interacting with the environment containing the medium and the object, in order to provide theoretical guidance for the measurement experiments. The modeling was based on the Monte Carlo statistical method, by tracking the photons emission process, scattering, reflection and update of the corresponding polarization state in the environment, and then counting the energy of polarized photons received by the detector. The model flow chart is shown in Fig. S1.

Ref. [1,2] provide a polarimetric scattering modeling method, including an update of the photon movement state and polarization state after scattering. Please refer to the source code for details:

https://omlc.org/software/polarization/

Ref. [3,4] provide a geometric modeling method of rough surfaces, including the determination of a photon's reflection direction. Please refer to the source code for details:

https://tatsy.github.io/blog/applications/graphics/1742/
https://github.com/tatsy/MicrofacetDistribution

Ref. [5-9] provide a polarimetric reflection modeling method, including the determination of a reflected photon's Mueller Matrix and updated of polarization state. Please refer to the source code for details:
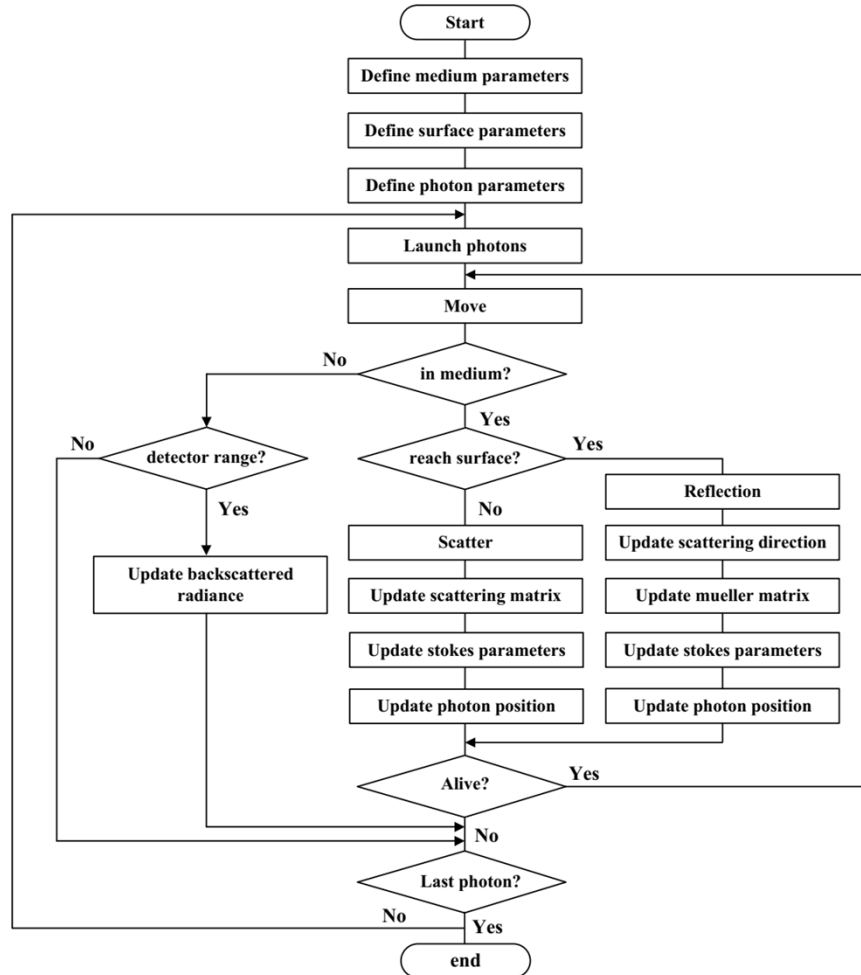
https://pages.nist.gov/SCATMECH/docs/index.htm

Start

Define medium parameters

Define surface parameters

Define photon parameters

Launch photons

Move

in medium?

No

Yes

detector range?

reach surface?

Reflection

No

Yes

No

Yes

Update backscattered radiance

Scatter

Update scattering direction

Update scattering matrix

Update mueller matrix

Update stokes parameters

Update stokes parameters

Update photon position

Update photon position

Alive?

Yes

No

Last photon?

No

Yes

end

Fig. S1 The modeling method flow chart

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